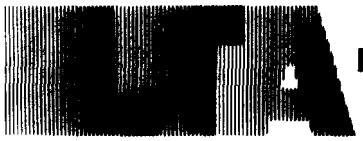
DOCKET FILE COPY ORIGINAL

RECEIVED

JUL 19 1993

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY



Leslie Taylor Associates

Telecommunications Consultants
6800 Carlynn Court
Bethesda, Maryland, 20817-4302
Tel: (301) 229-9341
Fax: (301) 229-3148

July 19, 1993

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Room 222
1919 M Street, N.W.
Washington, D.C. 20554

Re: ET Docket No. 93-198, Preparation for International Telecommunication Union World Radiocommunication Conferences

Dear Mr. Caton:

Enclosed are the original and required copies of the comments of Loral Qualcomm Satellite Services, Inc. in the above-referenced proceeding.

If you have any questions concerning this matter, please contact the undersigned.

Sincerely yours,

Leslie A. Taylor

Leslie A. Taylor

Enclosures

No. of Copies rec'd 0+4
List A B C D E

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Preparation for International	)	ET Docket No. 93-198
Telecommunication Union	)	
World Radiocommunication	)	
Conferences	)	

COMMENTS OF LORAL QUALCOMM SATELLITE SERVICES, INC.

Linda K. Smith
William D. Wallace
CROWELL & MORING
1001 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
(202) 624-2500

Leslie A. Taylor
LESLIE TAYLOR ASSOCIATES
6800 Carlynn Court
Bethesda, MD 20817
(301) 229-9341

Attorneys for Loral Qualcomm
Satellite Services, Inc.

July 19, 1993

Table of Contents

Summary iii

I. Introduction 2

II. The United States Should Seek Reconsideration of the Secondary Allocation of 1613.8 - 1626.5 MHz in the Space-to-Earth Direction 4

III. The United States Should Propose the Allocation of Feeder Links for MSS Systems 6

IV. The United States Should Propose Acceleration of the Worldwide Availability for MSS of Spectrum in the 2 GHz Band 8

V. The United States Should Place on the WRC-95 Agenda an Increase in the Power-Flux Density Limit for the 2483.5 - 2500 MHz Band 11

VI. The United States Should Ensure the Primary Status of MSS

Summary

Loral Qualcomm Satellite Services, Inc. (LQSS) recommends that the United States utilize the upcoming World Radiocommunication Conferences as opportunities to revise the International Radio Regulations so as to promote the development of mobile satellite service (MSS). The Federal Communications Commission recognizes, and the U.S. Department of Communications has documented, that demand for mobile communications services is enormous and expected to continue its rapid rate of growth. United States equipment manufacturers and service providers have been in the forefront of the mobile communications phenomenon, to the benefit of both

(4) an increase in the power-flux density limit for the 2483.5-2500 MHz band;

(5) revision of Footnote 731E to ensure the primary status of MSS in the 1610-1626.5 MHz band; and

(6) revision or deletion of RR 2613.

Action by WRC-93 to place these items on the agenda of WRC-95 will serve to clarify the operating environment for MSS systems and to address spectrum-related issues such as feeder link availability. These important subjects should be included in the United States recommendations for WRC-93.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Preparation for International	)	ET Docket No. 93-198
Telecommunication Union	)	
World Radiocommunication	)	
Conferences	)	

COMMENTS OF LORAL QUALCOMM SATELLITE SERVICES, INC.

Loral Qualcomm Satellite Services, Inc. (LQSS), by its attorneys, hereby submits its comments in response to the Commission's Notice of Inquiry, ("Notice"), in preparation for upcoming International Telecommunication Union World Radiocommunication Conferences.[1]

LQSS, as an applicant for authority for a non-geostationary 48-satellite system providing voice, data and radiodetermination satellite-service (RDSS) in the 1610-1626.5 MHz and 2483.5-2500 MHz band, has significant interests in upcoming international radiocommunication conferences. The United States also has a significant interest in promoting the use of these MSS frequency bands to benefit users of communications service as well as other U.S. interests. The United States can advance the goals of spectrum efficiency, multiple entry and economy of operation of U.S.-based MSS systems by placing on the agenda of future WRCs the matters proposed herein.

---

[1] In the Matter of Preparation for International Telecommunication Union World Radiocommunication Conferences, ET Docket No. 93-198, FCC No. 93-328, released June 28, 1993.

I. Introduction

The Commission, in its Notice, seeks input on spectrum allocation matters, ITU restructuring and the Report of the Voluntary Group of Experts on simplifying the International Radio Regulations. The Notice states that the ITU Administrative Council has already recommended that WRC-93 include on its agenda for the WRC-95, "guidance on facilitating use of frequency bands allocated to the mobile-satellite service worldwide."[2] The Commission goes on to note that, "WRC-93 therefore presents an opportunity for the United States to advocate resolution of issues affecting use of these bands and satellite feeder links at WRC-95."[3] Specific comment is sought on the footnotes relating to use of MSS allocations as well as the various resolutions adopted or modified at WARC-92 that affect use of the MSS frequency bands.

LQSS believes that the proceedings of the past two and one-half years involving the MSS system proposals for the 1610-1626.5 MHz and 2483.5-2500 MHz bands are instructive for the present and future needs of MSS systems and the technical issues which must be resolved to promote such systems. These proceedings, both before the Commission and in other fora such as Radiocommunication Study Groups, provide much useful information regarding the issues that are crucial to the implementation of MSS in these bands, both in the United States and around the world. In these comments, LQSS has drawn on information developed in these proceedings, and identified issues which should be addressed in the international fora of WRCs.

The Commission, in its Notice of Proposed Rulemaking, ("Spectrum NPRM") recommending the allocation of the 1610-1626.5 MHz and 2483.5-2500 MHz bands,[4] identified

---

[2] Id., para. 8.

[3] Id.

[4] See, Notice of Proposed Rulemaking and Tentative Decision, Amendment of Section 2.106 of the Commission's Rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile Satellite Service, including Non-geostationary Satellites, ET Docket No. 92-28, 7 FCC Rcd 6414 (1992) and Establishment of An Advisory Committee to Negotiate Proposed Regulations, CC Docket NO. 92-166, DA 92-1085, released August 7, 1992.

many of the issues which may need to be considered at future World Radiocommunication Conferences. The Commission, in this Spectrum NPRM asked for comment on:

(1) sharing of spectrum by geostationary and non-geostationary systems;
(2) impact of utilization of different access techniques;
(3) sharing of spectrum between RDSS/MSS systems and operations of the radio-astronomy service;
(4) sharing of spectrum between RDSS/MSS systems and operations of the aeronautical radionavigation service;
(5) sharing of spectrum between RDSS/MSS systems and the Russian GLONASS system;
(6) effect of operation of systems on a bidirectional basis in the 1610-1626.5 MHz band;
(7) uplink e.i.r.p. density limits in the 1610-1626.5 MHz band;
(8) downlink power-flux density limits in the 2483.5-2500 MHz band;
(9) the need for feeder links in specified bands.

These issues generated substantial comment and are also being addressed in the Radiocommunication Study Group 8(D).

To assist it in developing rules for the use of these bands, the Commission also instituted a Negotiated Rulemaking. Although the Negotiated Rulemaking Committee did not submit a report containing unanimous concurrence on all subjects, the extensive analysis undertaken, as well as the conclusions offered, can assist the Commission, not only in the domestic Spectrum NPRM, but also in formulating recommended U.S. positions for future World Radiocommunication Conferences.

The Commission in formulating its recommendations for future WRCs, should begin with the objectives it outlined in establishing the MSS Above 1 GHz Advisory Committee. The key objectives were stated as:

(a) what technical rules should be adopted for this service so as to maximize the sharing of the spectrum and the capacity for multiple entry, and

(b) what technical rules should be adopted in order for this service to co-exist

with other allocated services.[5]

These objectives are equally applicable as the Commission seeks to develop proposed U.S. positions to facilitate "use of frequency bands allocated to the mobile-satellite service worldwide."[6]

II. The United States Should Seek Reconsideration of the Secondary Allocation of 1613.8 - 1626.5 MHz in the Space-to-Earth Direction

A top priority for the United States should be to place on the agenda for WRC-95 the rescission of the allocation of 1613.8-1626.5 MHz in the space-to-Earth direction on a secondary basis or the adoption of an understanding that such operation cannot in any way cause interference into primary MSS operations. As has become clear in the U.S. proceedings, operation of a secondary downlink by an MSS system in this band is infeasible from the standpoint of accommodating multiple systems and of affording protection to other communications services operating in the band. Moreover, secondary downlink operations would greatly impair the efficient use of these bands. And, of global concern is the possibility one system could monopolize the band because of the incompatibility of secondary downlinks with primary operation by other users.

LQSS and other MSS applicants have previously expressed concern to the Commission about the feasibility of secondary MSS downlink operations in the 1613.8-1626.5 MHz band.[7] The international telecommunications community has also expressed concerns in this regard. In January, 1993, France submitted a paper within CCIR 8(D) describing the interference interactions caused by a secondary downlink operation. CCIR 8(D) in January sent forward a

paper, 8D/TEMP/81(Rev.1)-E, entitled, "Working Document Towards a Draft New Recommendation - Levels of Interference from MSS systems Operating on a Secondary Basis into MSS Systems on a Primary Basis." The paper states that, "(I)nitial analysis indicated that it is difficult to protect the primary system from interference generated by the sidelobes and backlobe of the transmit antenna of the secondary system." 8D/TEMP/81 (Rev.1)-E at p. 10.

Within the Radiocommunication Study Groups, additional work continues on the subject

cannot fulfill its goal of promoting efficient use of the spectrum and multiple entry through this allocation. The U.S. should ensure that the international allocation is reconsidered at WRC-95.

III. The United States Should Propose the Allocation of Feeder Links for MSS Systems

An area of critical importance for any proposed MSS system is the availability of feeder links. Thus far, this matter has not received sufficient attention. The United States should place the issue of feeder links for MSS systems, particularly for non-GSO systems, on the agenda for WRC-95.

LQSS has proposed the use of the 5150-5216 MHz band (downlink) matched with 6 GHz FSS spectrum (uplink) for the feeder links for its system. In its comments on the Commission's [redacted]

FSS and terrestrial systems for use of spectrum in the 20/30 GHz bands which some MSS systems propose for feeder links and recommends that the Commission ensure that spectrum in that frequency range also be made available.

Because of the global nature of the proposed MSS systems, LQSS recommends that the U.S. place the issue of feeder links for MSS systems on the agenda for WRC-95. Identifying this issue now will enable the U.S. and other administrations to address the issue of feeder link availability in preparation for that conference.

In addition, LQSS recommends that the U.S. propose amendment of Footnote 797A of the Radio Regulations to add RDSS/MSS feederlinks to the use for the 5150-5250 MHz (in addition to the 5150-5216 MHz band now available for RDSS feeder links). This change will be consistent with the action to allocate user links for MSS, and recognizes that aeronautical radionavigation has not made use of the band, despite years of stating that it planned to do so.[13] With spectrum a precious commodity for new and innovative telecommunications services, of great public and economic benefit, spectrum warehousing by public or private institutions should not be tolerated.

IV. The United States Should Propose Acceleration of the Worldwide Availability for MSS of Spectrum in the 2 GHz Band

At WARC-92, spectrum in the 2 GHz band was allocated for use by Mobile-Satellite Systems. Because these bands are currently used for terrestrial communications systems, the conference provided that the bands would be available at designated future dates. The following is a table which depicts the bands, along with the date of availability in the three ITU Regions:

[13] Id.

WARC-92 ALLOCATIONS FOR MOBILE SATELLITE SERVICE

BANDS	PATH	REGIONS	DATE
1492-1525 MHz	S to E	2 (subject to Aero. telemetry)	1993
1525-1530 MHz	S to E	2 & 3-Generic; 1-Maritime mobile primary, land mobile secondary	1993
1610-1626.5 MHz	E to S	1,2,3	1993
1613.8-1626.5 MHz**	S to E	1,2,3	1993
1675-1710 MHz*	S to E	2	1993
1930-1970 MHz**	E to S	2	1993
1970-1980 MHz	E to S	2	1996 (U.S.) 2005 (Region 2)
1980-2010 MHz	E to S	1,2,3	1996 (U.S.) 2005 (Global)
2120-2160 MHz**	S to E	2	1993
2160-2170 MHz**	S to E	2	1996 (U.S.) 2005 (Region 2)
2170-2200 MHz	S to E	1,2,3,	1996 (U.S.) 2005 (Global)
2483.5-2500 MHz	S to E	1,2,3	1993
2500-2520 MHz	S to E	1,2,3,	2005
2670-2690 MHz	E to S	1,2,3	2005

* Subject to coordination with meteorological satellite
** Secondary

Both prior to and since WARC-92, substantial interest in the provision of mobile-satellite service has arisen in the United States and elsewhere. In the United States, the Commission has under consideration six applications for the use of the 1610 - 1626.5 MHz and 2483.5 - 2500 MHz bands for MSS. The development of rules for use of these bands as well as the processing of the applications already has consumed substantial private sector and government resources.[14] This process has also produced substantial data on the present and future spectrum needs for MSS systems.

Several applicants have indicated to the Commission that they can operate compatibly in the same spectrum and propose the adoption of rules for use of the 1610 - 1626.5 MHz and 2483.5 - 2500 MHz bands on an interference sharing basis. Use of this approach would enable rapid resolution of the current proceeding and licensing of systems within the next few months, thereby speeding service to the public.

LQSS believes that on an interference-sharing basis, these initial bands will be adequate for its first generation system on a multiple entry basis. However, to accommodate expected growth in demand for MSS, and to accommodate both U.S. and non-U.S. systems that are likely to be implemented in the 21st century, MSS spectrum in the 2 GHz band should be available towards the end of this decade.

Thus, LQSS recommends that the U.S. at WRC-93 seek to include an agenda item for WRC-95 which specifically addresses acceleration of the availability for MSS of 2 GHz spectrum at the same time on a worldwide basis. Specifically, availability of the 1970 - 1980 MHz, 1980 - 2010 MHz, 2160 - 2170 MHz and 2170 - 2200 MHz should be accelerated to 1996. The sooner the issue of spectrum availability for second generation LEO MSS systems can be addressed, the greater certainty LQSS and other MSS applicants will have for planning purposes.

---

[14] Spectrum NPRM and Negotiated Rulemaking Proceeding, cited supra.

Because of the long lead time required for the planning, financing and construction of satellite systems, it is imperative that spectrum availability be known as far in advance as possible. In addition, acceleration of the date of availability of spectrum for MSS will provide administrations with a timetable for relocating current users of the bands as necessary.

V. The United States Should Place on the WRC-95 Agenda an Increase in the Power-Flux Density Limit for the 2483.5 - 2500 MHz Band

Along with other actions to enhance MSS at WRC-95, the U.S. should seek a modest increase in the power-flux density coordination trigger value for the 2483.5 - 2500 MHz band. Such an increase would enhance the capacity of systems using the band, improve the intra-service sharing environment and minimize potential coordination with terrestrial systems using the band.

LQSS, in its initial system application, proposed to operate at no greater than the following power flux density:

> -145 dBW/m^2 for any 4 kHz band for angles of arrival between 10 and 90 degrees. The power flux density does not decrease with decrease in angle of arrival because the S-band antenna is designed for isoflux.[15]

[redacted]

-152 dB(W/m^2) in any 4 kHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

-152 + 0.5(δ - 5) dB(W/m^2) in any 4 kHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane;

-142 dB(W/m^2) in any 4 kHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

These limits relate to the power flux-density which would be obtained under assumed free-space propagation conditions.

LQSS believes that a further revision would promote the implementation of MSS and reduce the need for coordination with terrestrial services. LQSS urges that the U.S., at WRC-93, seek an agenda item for WRC-95, the revision of the PFD for the MSS downlink band. LQSS recommends trigger values as follows:

-152 dB(W/m^2) in any 4 kHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

-152 + 0.65(δ - 5) dB(W/m^2) in any 4 kHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane;

-139 dB(W/m^2) in any 4 kHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

These limits relate to the power flux-density which would be obtained under assumed free-space propagation conditions.

Use of these slightly higher values will enable systems such as Globalstar to proceed without the need for time-consuming and unnecessary coordinations with terrestrial systems.

In support of this value, LQSS notes the following. Within the Radiocommunication Study Group 8(D), information is being developed concerning the development of a PFD mask

which could be used to analyze sharing between MSS and terrestrial systems in the Fixed Service.[17] The availability of such a mask would simplify the task of determining when MSS systems might cause interference to those in the Fixed Service. LQSS also is developing a paper for submission within the U.S. Radiocommunication Sector process which will analyze MSS and FS sharing on the basis of a PFD mask. LQSS' preliminary analysis indicates that sharing is feasible at higher PFDs than are specified in Radio Regulation 2566.

In addition, during the recently concluded Negotiated Rulemaking, substantial analysis was undertaken on the effects of PFD on the compatible operation of multiple systems as well as the impact of PFD on cumulative system capacity. The results of these analyses are discussed in the Report of the Majority of Active Participants of Informal Working Group 1. The analysis concludes that an appropriate PFD for CDMA systems, to achieve service objectives, operate compatibly and attain maximum cumulative capacity, is in the range of -139 dBW/m^2-4kHz.[18] This Report states that, "even without PFD limits, the individual (CDMA) systems, in attempting to optimize their capacity and efficiency, end up with PFDs in a small range about -139." [19] An analysis of the co-frequency, co-coverage situation for CDMA and FDMA/TDMA systems also discusses the need for a higher PFD than the existing coordination trigger. [20]

The work of the Negotiated Rulemaking Committee on the subject of inter-system sharing, addressed in Part 3.0 of the MSS Above 1 GHz Negotiated Rulemaking Committee Report to the Commission[21], indicates that increasing the PFD in the 2483.5-2500 MHz band is unlikely to have adverse consequences for other services using the band. The Advisory Committee examined

---

[17] See 8D/106, "Sharing between the Fixed Service (FS) and the Mobile-Satellite Service (MSS) in the 1-3 GHz Range", submitted at the January 8(D) meeting by the United Kingdom, and Document 8D/TEMP/42.

[18] Report of the Majority of the Active Participants of IWG-1 of the MSS above 1 GHz Negotiated Rulemaking Committee, p. 5-11.

[19] Supra., p. 5-26.

[20] Supra., p. 5-37.

[21] See MSS Above 1 GHz Negotiated Rulemaking Committee Report, pp. 25-27.

various other services operating in the 2483.5 - 2500 MHz band. These include: industrial, scientific and medical devices (such as microwave ovens), multi-point distribution systems (MDS), and limited numbers of terrestrial fixed and mobile systems. IWG-3 noted that the proposed MSS systems were unlikely to interfere with these systems. The transmission characteristics, power levels and path direction of the systems operating in the band reduce the potential for interference from MSS. Consequently, a small increase in the PFDs of MSS systems is unlikely to alter the very minimal likelihood of interference from MSS.

Thus, the analysis of the PFD needed to allow for optimum sharing of the downlink MSS band, as well as on-going work within the ITU, points to a need to review the currently applicable PFD trigger value. The U.S. should ensure that this subject is addressed at WRC-93, and placed on the agenda of WRC-95.

VI. The United States Should Ensure the Primary Status of MSS in the 1610-1625.5 MHz Band by Obtaining a Revision of Footnote 731E

At WARC-92, the U.S. was successful in obtaining a primary allocation for MSS in the 1610 - 1626.5 MHz band. However, in order to obtain worldwide consensus on this allocation, Footnote 731E of the Radio Regulations was adopted. This footnote provides:

> The use of the band 1610-1626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. A mobile earth station operating in either of the services in this band shall not produce an e.i.r.p. density in excess of -15dB(W/4kHz) in the part of the band used by systems operating in accordance with the provisions of No. **732**, unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, a value of -3dB(W/4 kHz) is applicable. Stations of the mobile-satellite services shall not cause harmful interference to, or claim protection from, stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. 732 and stations in the fixed service operating in accordance with the provisions of No. 730.[22]

[22] Underlining is added to emphasize section which creates a conflict with the primary allocation for MSS.

LQSS believes that the underlined section of Footnote 731E should be deleted.

The original purpose of the underlined language was to provide reassurance to the administrations with specific systems in the band (Sweden and Russia) that MSS systems would not cause them harmful interference. In the case of Sweden, the systems involved are radar systems of limited geographic scope. In the case of Russia, the system encompassed by Footnote 732 is the GLONASS system operating in the 1602 - 1616 MHz band as coordinated under Article 14 of the Radio Regulations.[23]

During the Above 1 GHz NRM, analysis indicated that the Swedish radar system would not be adversely affected by MSS.[24] However, with regard to the GLONASS system, the Advisory Committee reported to the FCC that operations at the uplink e.i.r.p. density limits recommended by WARC-92 in Footnote 731E (-15 dBW/4kHz) could interfere with receipt of GLONASS signals by receivers operating in the same vicinity as mobile earth stations (MESs). At the present time, the international aviation community is considering the use of both the U.S. DOD-funded Global Positioning System (GPS) and GLONASS for navigation, including possible use for gate-to-gate navigation. The aviation community believes that use of both of these systems is needed to provide it with the level of integrity of navigational data it requires to use satellite systems for "sole means" navigation.

Navigation using GPS and/or GLONASS is accomplished as follows, as described in the Report of Informal Working Group 2 of the MSS Above 1 GHz Negotiated Rulemaking Committee:

> The user segment will consist of antennas and receiver-processors that provide positioning, velocity and precise timing to the user. The GPS/GLONASS receiver

---

[23] Article 14 of the Radio Regulations provides the procedures for coordination of systems when affirmative agreement of other administrations must be obtained.

[24] The Report of Drafting Group 2C (Sharing with Services other than Aeronautical Radionavigation and Radioastronomy) concluded that, "Swedish radars operating in the L-band, because of their sparse locations and pulsed operations, will not cause harmful interference to MSS operators with well designed receivers, nor will MSS operations interfere with them." Report of Drafting Group 2C to IWG-2 of the MSS Above 1 GHz Negotiated Rulemaking Committee, at p. 3.

> automatically selects appropriate signals from four of the satellites best in view based on optimum satellite-to-user geometry. It then solves time-of-arrival difference quantities to obtain distance between user and satellites. This information establishes the user position with respect to the satellite system. A time correction factor then relates the satellite system to earth coordinates. User equipment measures four independent pseudo-ranges and range rates and translates these to three-dimensional position, velocity and system time.[25]

However, the aviation community has stated the desire for even more satellites in view to attain the desired availability factor. RTCA, Inc. (Radio Technical Committee for Aviation) states that:

> (I)n order to assure the integrity[26] of navigational data from GNSS, RTCA has specified that a minimum of 5 satellites in appropriate geometry must be continuously in view to obtain an availability[27] of 99.999%.[28]

In order to enhance the probability of attaining the availability sought by aviation, RTCA recommends that aviation use both the GPS and GLONASS system for navigation.[29] The United States Federal Aviation Administration has not yet formally endorsed the reliance on both GPS and GLONASS.[30]

---

[25] Report of Informal Working Group 2 (Inter-service Sharing Issues) to the MSS Above 1 GHz Negotiated Rulemaking Committee, April 7, 1993, at p. 2.

[26] "Integrity" is defined by RTCA as "the assurance that all functions of a system perform within operational performance limits." RTCA Task Force Report on the Global Navigation Satellite System (GNSS) Transition and Implementation Strategy, Appendix B, p.4.

[27] RTCA defines "availability" as "the percentage of time that the services of the system are within required performance limits. Availability is an indication of the ability of the system to provide usable service within the specified coverage area. Signal availability is the percentage of time that navigational signals transmitted from external sources are available for use. Availability is a function of both the physical characteristics of the environment and the technical capabilities of the transmitter facilities." Supra., Appendix B, p. 2.

[28] Report of Informal Working Group 2, p. 19, citing the RTCA Task Force Report.

[29] RTCA Report, p. 2.

[30] See 1992 Federal Radionavigation Plan, published jointly by the Department of Transportation and the Department of Defense, January, 1993. The Plan does state, however, that "(O)pportunities exist to develop receiver avionics which combine two radionavigation signals,

An additional element in this equation is the development of standards for GPS and GLONASS receivers. Depending on the receiver standards adopted, the sharing situation between GLONASS and MSS could be improved. As in most situations involving standards, there are cost/quality trade-offs. In the case of GPS and GLONASS, receiver manufacturers seek to achieve the operational objective at lowest cost. This approach increases the already large margin of protection required of other services operating co-frequency, as well as out-of-band emission limits on services operating in adjacent frequencies.[31]

The Negotiated Rulemaking Committee sought to find a solution to the dilemma of providing protection for the GLONASS system from MSS, at the same time ensuring that MSS systems would be able to utilize their co-primary allocations. Another co-primary user of a portion of the 1610 - 1626.5 MHz band, radioastronomy, provides a key to proposed solutions. Radioastronomy has experienced substantial interference from GLONASS. Because of this interference, radioastronomers have proposed that GLONASS revise its operations (over the next few years) so that eventually, all GLONASS satellites operate on frequencies below 1610 MHz.

This solution also would resolve incompatibilities between GLONASS and MSS. The NRM Committee recommended that the FCC and the U.S. government work with Russia to accomplish this frequency shift (or develop other alternative solutions). Appendix A to these comments summarizes some of the alternatives recommended by the Advisory Committee, along with additional alternatives developed by LQSS.

Within Radiocommunication Study Groups, this issue is being addressed as well. A document, 7D/TEMP/17E, proposes a frequency shift for GLONASS.[32]

---

such as GPS/Loran-C, GPS/GLONASS, GPS/Omega, and GPS/VOR/DME, and thereby significantly improve user navigation performance." at p. 4-12.

[31] See Report of IWG-2B, pp. 6-15.

[32] To resolve both the MSS/GLONASS and radioastronomy/GLONASS issues, GLONASS would operate on a center frequency no higher than 1605.375 MHz. The GLONASS transmissions should be filtered so that emissions above 1610.6 MHz will be substantially reduced.

VII. The United States Should Propose that Revision of RR 2613 be Placed on the Agenda of WRC-95

Another international regulation which should be revisited in order to promote the use of the MSS allocations is Radio Regulation 2613. Radio Regulation 2613 provides:

> Non-geostationary space stations shall cease or reduce to a negligible level their emissions, and their associated earth stations shall not transmit to them, whenever there is insufficient angular separation between non-geostationary satellites and geostationary satellites resulting in unacceptable interference to geostationary-satellite space systems in the fixed-satellite service operating in accordance with these Regulations.[33]

Radio Regulation 2613 was developed with a view towards protecting geostationary-satellite systems in the fixed-satellite service from possible interference from non-geostationary satellites. Because the vast majority of commercial satellite systems are geostationary, the interference interactions between such systems are well understood and the ITU has established protection criteria to ensure that the systems do not cause harmful interference to each other. However, because the interference mechanisms between non-geostationary and geostationary systems are not yet defined within the International Radio Regulations or within Radiocommunication Sector (formerly CCIR) recommendations, Radio Regulation 2613 was merely revised, but not eliminated at WARC-92.

The United States should seek to have Radio Regulation 2613 placed on the agenda of a future WRC because its present language is confusing and provides little guidance to operators of either geostationary or non-geostationary systems. During the Negotiated Rulemaking, the Committee recommended an interpretation of Radio Regulation 2613 as follows:

> Three conditions must be met before a non-geostationary system would be required to cease or reduce transmissions in order to protect a geostationary system. First, the administrations of the systems involved must engage in bi-lateral or multi-lateral discussions and reach agreement as to a level of "accepted interference" (see RR 162). Second, after the systems are in operation, the non-geostationary system must exceed the level of interference agreed to. Third, the interference in excess of the agreed level must be caused by the failure of the non-

[33] RR 2613, International Radio Regulations, as modified at WARC-92.

geostationary system to maintain sufficient angular separation between the satellites of the two systems. If any of the three conditions is not met, RR 2613 cannot be invoked to affect the operations of any non-geostationary satellites.[34]

This interpretation is proposed to be used by the United States and, as recommended by the Negotiated Rulemaking Committee, proposed by the United States as the interpretation to be applied internationally. To do otherwise may convey the misconception that non-geostationary satellites have a lesser status vis a vis geostationary FSS satellites from the standpoint of interference situations.

Ultimately, as the Radiocommunication Sector develops appropriate recommendations to be used in the coordination of non-geostationary MSS systems, and the method of calculating interference between non-geostationary MSS systems and geostationary FSS systems is clearly defined, LQSS believes that RR 2613 should be eliminated entirely.

VII. Conclusion

LQSS recommends that the United States move forward at WRC-93 to establish a specific agenda for addressing a number of issues that relate to the implementation of mobile-satellite service. Identifying the issues proposed by LQSS for consideration at WRC-95 will assist in enabling the MSS applicants, including LQSS, to finalize system design and and to implement their systems in the near future, benefitting both the public as well as United States competitiveness.

[34] Report of IWG-3 to the NRM Above 1 GHz Negotiated Rulemaking Committee, April 7, 1993, p. 68.

Respectfully submitted,

LORAL QUALCOMM SATELLITE SERVICES, INC.

By: Linda K. Smith

Linda K. Smith
William D. Wallace
CROWELL & MORING
1001 Pennsylvania Avenue N.W.
Washington, D.C. 20004-2505
(202) 624-2500

By: Leslie A. Taylor

Leslie A. Taylor
LESLIE TAYLOR ASSOCIATES
6800 Carlynn Court
Bethesda, MD 20817-4302
(301) 229-9341

July 19, 1993

Appendix A

Spectrum Sharing between MSS and GLONASS: Alternatives[1]

THE ISSUE

Intended Use of GLONASS

- Both the 24 satellite GPS constellation and the 24 satellite GLONASS constellation are considered by the international aviation community as integral parts of the Global Navigation Satellite System (GNSS). According to aviation, neither constellation provides the coverage necessary to provide the the self-contained system integrity checks specified by aviation. In integrated use through GNSS the desired level of redundant measurements to make receiver autonomous integrity monitoring (RAIM) practical supposedly would be achieved. The aviation community seeks to use GNSS for en route, oceanic, and non-precision approach navigation with an accuracy of 100 m. The aviation community envisions that GNSS will provide the sole means of aeronautical navigation from gate to gate.

Frequency Allocation

- The GLONASS satellite system consists of 24 satellites with eight satellites in each of three planes. A different operating frequency is assigned to each satellite with a center frequency between 1602.5 and 1615.5 MHz. A separate reference satellite operates at 1602.0 MHz.

- MSS systems are also allocated usage of the 1610 to 1615.5 MHz band on a co-primary basis. This represents an overlap of 6 MHz for potential sharing between the two systems. Based upon GNSS protection levels stated by the aviation community during the NRM and the maximum MES EIRP density as referenced in RR 731E, a separation distance of over 10,000 m between the GNSS receiver and a single MES user transmitter is required. Clearly, there are two major conflicting system requirements which found no resolution at the recently completed NRM. Multiple users on the same frequency and multiple MSS systems will only exacerbate the problem.

[1] This paper summarizes some of the proposals made during the Negotiated Rulemaking as well as additional options developed by LQSS.